

STRAIN FAMILY  
OF  
ISOLATING SIGNAL CONDITIONERS  
  
STRAIN-AC / STRAIN-DC

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IMO Precision Controls Ltd

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## 1.0 INTRODUCTION

The STRAIN range is a family of signal conditioners capable of accepting strain gauge, load cell, pressure gauge or mV input types into an isolated input stage and providing a separate isolated re-transmitted output.

Each unit is a full 3-port isolating device, the input, output and power supply input being isolated from each other.

An isolated excitation power supply is provided for gauge/ bridge applications. This can be used to provide DC voltage bridge excitation between 1.25 and 12V with maximum supply current of 40mA.

The instrument is available in two different formats each accepting a different type of power source. The STRAIN AC is mains powered whilst the STRAIN DC is powered by a low voltage source. This manual covers both formats. Input signal, output signal and power supply information are required to define any unit exactly. This information, together with a unique serial number, is printed on the side label of each unit; records of the exact configuration of every product shipped are maintained at the factory.

### 1.1 Input Types and Ranges

Both members of the STRAIN family share the same input stage.

Inputs can be specified either in mV or in gauge/ bridge sensitivity in mV/V, with the required bridge excitation voltage being stated.

In general, inputs are expected to be unipolar - however negative inputs down to -5mV can be accommodated to allow for bridge resistance offsets etc.

A positive offset can be specified to allow a gauge to be used with a pre-load (e.g. 10 to 30mV input range).

The limits on signals that can be handled with the accuracy specified in section 7 are:

MIN offset	MAX offset	MIN span	MAX span
-5mV	+100mV	10mV	100mV

The limits on excitation voltage are:

VOLTAGE	MAXIMUM CURRENT	MIN BRIDGE RESISTANCE
1.25V	30mA	42
2.5V	30mA	84
5.0V	40mA	125
7.5V	40mA	188
10.0V	50mA	200
12.0V	50mA	240

Any combination of these parameters can be specified at the point of order. Alternatively the default configuration can be requested.

The default configuration provides 10V excitation as standard with adjustable gain to cover the range from 1mV/V to 4mV/V. A zero offset of +/- 3mV can be accommodated.

Signal ranges outside those detailed above may be possible with modified accuracy specifications - consult factory for details.

### 1.2 Output Types and Ranges:

## STRAIN USER MANUAL

Both members of the STRAIN family share the same output stage which can provide two types of output:

	OUTPUT FULL SCALE RANGE		Over range limit (approximately)
	MIN	MAX	
i) Current Source	1mA into 12 K ohm MAX	20mA into 600 ohm MAX	+ 30%
ii) Buffered voltage source	100mV into 200 ohm MIN	12V into 2K4ohm MIN	+30%

This includes all standard output ranges such as 0-10mA, 4-20mA, 0-20mA, 1-5V and 0-10V.

The output range should be specified at the point of order. Alternatively either the default, or the user reconfigurable, output option can be chosen.

The default output range is 4 - 20mA whilst the user reconfigurable option allows 0 - 10V, 4 - 20mA or 0 - 20mA output to be user selected with internal switches (units conforming to this option will be shipped as 0 - 10V output unless otherwise requested).

### 1.3 Power Supply

#### STRAIN AC

The STRAIN AC is user reconfigurable by internal voltage selector switch for 115 or 230 V AC, 50/60 Hz. The voltage tolerance is +/- 10% on either voltage for specified performance. If mains voltage is not specified then the unit will be set at 230V.

Current consumption at 115V is about 50mA RMS.

#### Fusing

The STRAIN AC incorporates a non-resettable thermal cutout on the mains input which will operate in the case of overheating. The low voltage circuitry is protected by resetting fuses.

**IMPORTANT! - The STRAIN AC should additionally be protected by a 100mA anti surge fuse (T 100mA), with a voltage rating of 250V AC and a breaking capacity of 35 A at 250 V AC, placed in series with the live power input.**

#### STRAIN DC

The STRAIN DC is factory set for the standard requirement of 24 V DC. The voltage tolerance is +/- 10% for specified performance.

Maximum current consumption at 24 V is 100mA for current output units or 150mA for voltage output or user reconfigurable output units.

5V DC, 12V DC and 24V AC, supplies can be catered for by specific request - contact factory for details.

#### Fusing

The STRAIN DC incorporates an internal 200mA self resetting fuse - No external fusing is necessary.

## 2.0 UNPACKING

Please inspect the instrument carefully for signs of shipping damage. The unit is packaged to give maximum protection but we can not guarantee that undue mishandling will not have damaged the instrument. In the case of this unlikely event, please contact your supplier immediately and retain the packaging for our subsequent inspection.

## 2.1 Checking the Unit Type

Each unit has a unique serial number label (fig.1 below) on which full details of the configuration are given. These details should be checked to ensure conformance with your requirement.

<b>IMO</b>		<b>CE</b>
PART NUMBER	STRAIN-AC	
INPUT	3mV/V	
OUTPUT	4-20mA	
SUPPLY	230v AC	
OPTIONS	10V EXCITATION	
NATO STOCK No.		
SERIAL No.	STR2-199	

Fig. 1 - Serial Number Label

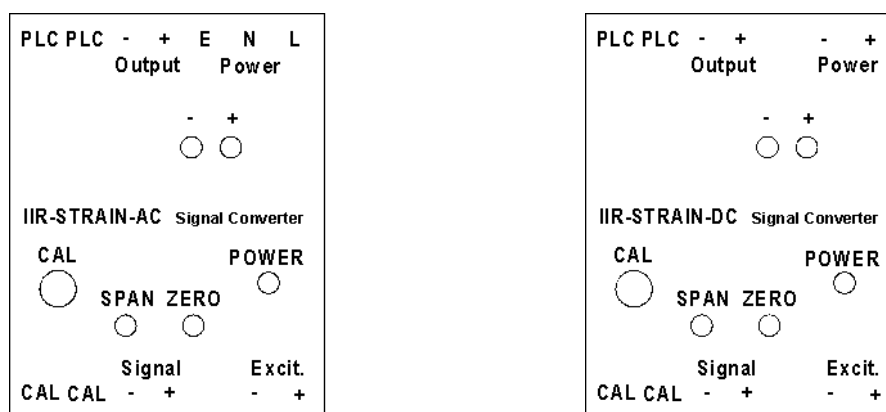


Fig. 2 - STR AIN Front Panel Labels

## 3.0 CONNECTIONS

This section details the instrument connection information. Before proceeding, please check the information on the serial number label on one side of the unit to ensure that the unit configuration is correct. Connection details are given on the front panel label as shown in fig.2 above.

### 3.1 Power Supply

The supply voltage is indicated on the serial number label.

**APPLICATION OF VOLTAGES HIGHER THAN THAT STATED FOR THE SUPPLY MAY CAUSE DAMAGE TO THE INSTRUMENT.**

Ensure that no bare wire protrudes from the rear of the power connector risking a short circuit. We advise the use of bootlace ferrules on all bare wires.

#### STRAIN AC

The live conductor (suitably fused, as discussed earlier) must be connected to L, the neutral to N and protective earth to E.

#### STRAIN DC

The supply polarity is clearly marked - however reverse polarity connections will not damage the unit.

### 3.2 Bridge Connections

#### 3.2.1 Signal Inputs

The bridge output or mV signal should be connected to the SIG + and - terminals appropriately. Reverse polarity signals will not damage the unit.

#### 3.2.2 Excitation output

The excitation + and - terminals should be connected to the bridge excitation terminals appropriately. Reverse connection will result in negative bridge output but will not damage the unit.

### 3.3 Output Connections

Regardless of output type the common, return or negative of the output circuit should be connected to the out - terminal. Similarly the positive connection should be made to the output + terminal.

### 3.4 Test Terminals

On the front of the unit are two brass terminals marked + and -. They can be used to check the mA output of the unit without breaking the output loop. A voltage of 10mV per mA is present (i.e. 4 - 20 mA will read 40 - 200mV). Accuracy is +/- 1%, so the terminals should be used for indication only rather than for calibration purposes.

### 3.5 'CAL' Button; 'CAL' & 'PLC' Terminals

The 'CAL' button simply places a momentary short circuit across the 'CAL' terminals when it is pressed. The 'CAL' terminals are not internally connected to any other circuitry. The user may make use of this switch in his own calibration circuit if desired. The 'PLC' terminals are not normally connected and may be ignored.

## 4.0 RECONFIGURING THE INSTRUMENT (applies to reconfigurable units only)

In many cases the instrument is factory configured in which case this section can be ignored. However, if the output of the unit is reconfigurable this will be stated on the serial number label.

In order to reconfigure the output of the instrument it is necessary to remove the circuit assembly from the plastic enclosure. This is achieved by gently levering apart both the grey sides at the front of the unit, such that the black connector pips are released, and sliding the black connector blocks forward about 5cm (2inches).

### 4.1 Output Configuration

The output of a reconfigurable unit may be configured to give any of the following DC ranges:

0-20mA  
4-20mA  
0-10V  
2-10V

Behind the power connectors are two slide switches which should be moved towards the front or back of the unit as follows:

Output Required	Outer Switch Position	Inner Switch Position
4-20mA	Front	Front
0-20mA	Front	Back
0-10V	Back	Back
2-10V	Back	Front

### 4.2 Mains voltage selection (applies to STRAIN AC only)

The mains voltage of the STRAIN AC can be set to a nominal 115V or 230V input. Behind the black connector block housing the power connections is a large slide switch - slide the black lever fully towards the front of the unit to reveal "115" legend, for 115 V or towards the back revealing "230" for 230V.

## 5.0 RECALIBRATION

All units are factory calibrated; although the user may wish to recalibrate with greater frequency, a two yearly recalibration interval is adequate for most applications.

In the case of reconfigurable units, recalibration must be carried out after any change of configuration.

With appropriate input values use front panel zero and span pots to obtain desired zero scale and full scale voltage or current output (preferably into the actual circuit load resistance, for greatest accuracy). It may be necessary to repeat each adjustment to ensure correct calibration.

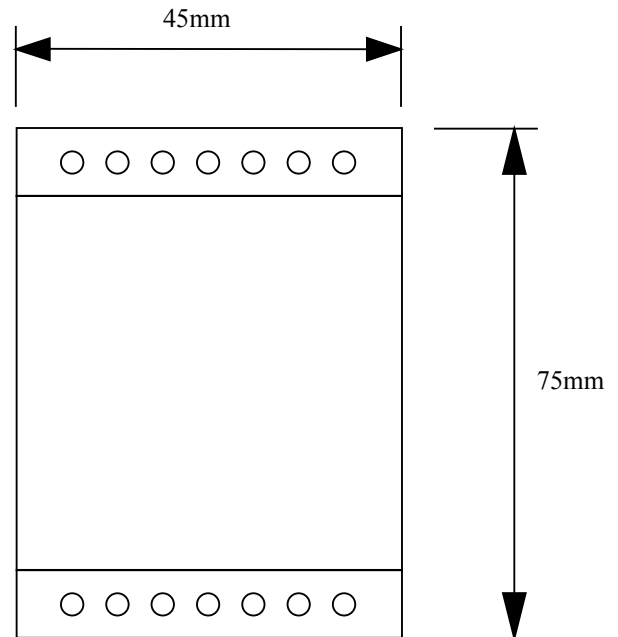
Additionally it is recommended that the input should be taken slightly under and over the required range after calibration to check that the unit is in its linear region. If in doubt, contact the factory - technical support staff will be pleased to help.

## 6.0 INSTALLATION

Fig. 3 - Installation Data For STRAIN

Installation Data \_\_\_\_\_

Mounting	DIN Rail T35
Orientation	Any (Vertical Preferred)
Connections	Screw Clamp With Pressure Plate
Conductor Size	0.5mm - 4.0 mm
Insulation Stripping	10mm
Screw Terminal Torque	0.4Nm Max.
Weight	340g (approx.) (STRAIN-AC)
Depth Of Unit	110mm



### 6.1 Installation onto Rails

The instrument is designed to mount directly onto the "Top hat" TS35 standard assembly rail to DIN 46277 part 3/EN 50022/BS5584.

### 6.2 Mounting Arrangements

Ideally the unit should be mounted in a vertical position, i.e. on a horizontal rail. This is the optimum orientation to minimise temperature rise within the unit. However successful operation is possible in any orientation.

Ensure the maximum ambient temperature is less than 55°C.

Good airflow around the unit will maximise reliability.

### 6.3 Wiring Precautions

The unit accepts sensor inputs, some of which produce very small signals. Therefore it is advisable to adhere to the following rules of good installation practice.

- Do not install close to switchgear, electromagnetic starters, contactors, power units or motors.
- Do not have power or control wiring in the same loom as sensor wires.
- Use screened cable for sensor wiring with the screen earthed at one end only.
- Take care not to allow cut pieces of wire to fall onto the unit as they might enter via the ventilation holes and cause electrical short circuits. if in doubt, remove the units from the rail until wiring is complete.
- Use bootlace ferrules on all bare wires.

**IMPORTANT: The connection terminals are designed for a maximum torque of 0.4Nm. Exceeding this figure is unnecessary and will result in unwarrantable damage to the unit.**



## 7.0 SPECIFICATIONS

All specifications are at 20°C operating ambient with 250Ω output load (current output) unless otherwise stated.

### Accuracy and Response

#### SIGNAL PATH (excluding excitation supply)

Calibration accuracy at zero and full scale	+/- 0.05% full scale
Linearity	+/- 0.1% full scale
Zero drift	+ / - 50ppm full scale /°C
Gain drift	+/- 100ppm /°C
Gain dependence on load resistance, $R_L$	-10ppm / $\Omega$ , $0 \leq R_L \leq 600\Omega$
Response Time (90% of step change)	150ms typical <sup>1</sup>

#### EXCITATION SUPPLY

Initial voltage accuracy	+/- 5% of stated voltage
Thermal drift	+/- 100 ppm /°C

### Power Supply and Isolation voltage

#### STRAIN DC

Operating Voltage	24V DC +/- 10%
Current consumption <sup>2</sup>	150mA typical
Input to output to power supply isolation (3 port)	1kV DC

#### STRAIN AC

Operating Voltage	115V or 230V AC 50/60 Hz +/- 10%
Current Consumption <sup>3</sup>	50mA/25mA typical
Input to Output Signal Isolation	1KV DC
Power supply to input/ output signal isolation	4KV AC

### Operating Ambient

Operating temperature range	0 - 55°C
Storage temperature range	-40 - 100°C
Operating & storage humidity range	0 - 90% RH

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<sup>1</sup> Faster response time is possible - contact factory for details

<sup>2</sup> Upscale output (25mA/12V)

<sup>3</sup> Upscale output (25mA/12V)

### EMC performance

#### EMC performance

Both the STRAIN AC and STRAIN DC conform with the protection requirements of Council Directive 89/336/EEC on the approximation of the laws of members states relating to electromagnetic compatibility (Article 10 (1)):

1) Radiated Emissions:

The units meet EN55011: 1991 (Group 1, Class B) and EN55022: 1987 (Class B)

2) EMC Immunity:

The units meet EN50082-2: 1995 as follows:

(i) ESD Immunity:

Performance is not degraded by 8 KV ESD to ground in the vicinity of the units. Direct ESD greater than 4 KV to the connection terminals or adjustment pots of the unit should be avoided.

IMPORTANT:

Service/ Maintenance personnel should take care to discharge themselves to the control cabinet/ systems earth before wiring, adjusting or calibrating the unit.

(ii) RF Immunity:

The outputs of the units vary by less than +/- 1% full scale with fields of  $10\text{Vm}^{-1}$  with 80% AM at 1KHz, between 800KHz and 1GHz with any field orientation.

(iii) Fast Transient Immunity:

During transients of 2 KV the outputs are temporarily affected and may vary by up to 5% full scale. During transients of 500V the outputs vary by less than +/- 1% full scale.

Hence the units are suitable for both “Light industrial” and “Industrial” environments.